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EXISTENCE AND CONDITION OF MINIMUM DEVIATION OF A PRISM

ROBERT E. SEALL*

Received September 5, 1946; published January 23, 1947

Experiments have shown that among all the possible paths of a light ray of a single color through a prism in a principal plane of the prism, there is always one and only one the path symmetrical with respect to the prism for which the prismatic deviation is an absolute minimum.

The conjecture just described was proved true by J. Larmor about 1896.[1] However much of Larmor's proof seems to be geometrical. Uhler has since given the problem of prismatic deviation a very thorough analytical treatment.[2, 3] However when dealing with a ray in a principal plane of a prism Uhler seems to be mainly concerned with the determination of the value of the minimum deviation rather than the proof of the existence of such a minimum and the accompanying condition of symmetry.

What is wanted now is an elementary analytical proof for the conjecture first described. The object in writing this article is to give just such a proof for the case in which the optical density of the prism exceeds that of the surrounding medium.

Lines a, b and c (see Figure 1) represent the path through a prism (of optical density greater than that of the surrounding medium) of a light ray of a single color which falls upon the prism in such a way that a, b and c all lie in the same principal plane. P and Q represent the points, one on each of the faces of the prism, through which the ray just described passes. Lines m and n represent the normals to faces of the prism at P and Q respectively. α represents the angle between planes or faces forming the prism. The prismatic deviation for the ray in question shall be regarded as a function of the incident angle x and be called $\psi(x)$.

From the figure

$$\alpha = y + v \tag{A}$$

and $\psi(x) = (x - y) + (z - v)$. Therefore

$$\psi(x) = x - \alpha + z, \tag{B}$$

*To Dr. L. E. Smith, of the Department of Physics, are due the thanks of the author for reading and correcting this article.

[1] J. Larmor, Proc. Camb. Phil. Soc. *9*, 109 (1896).

[2] H. S. Uhler, Am. Jour. Sci. *27*, 223 (1909).

[3] H. S. Uhler, Am. Jour. Sci., *35*, 389-423 (1913).

a value which is independent of the distance from P to the vertex of the prism. Then too from Snell's law of refraction

$$\begin{aligned} \sin x &= \mu \sin y, \\ \sin z &= \mu \sin v, \end{aligned} \tag{C}$$

where μ is the index of refraction. Also $\mu < 1$.

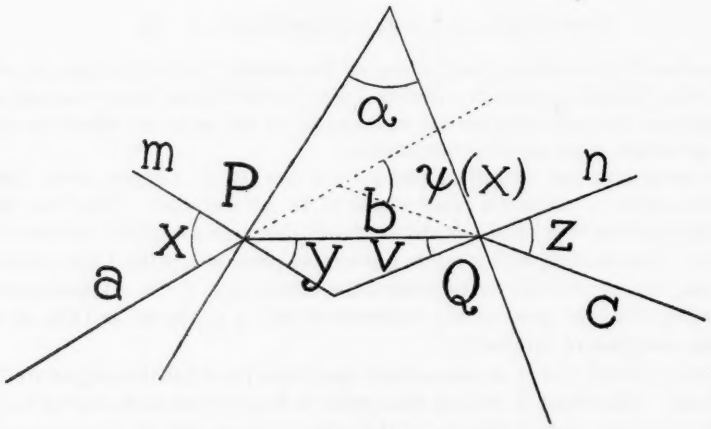

FIGURE 1

Now it can be seen from A and C that the conditions in the problem will be satisfied only if $0 < \alpha \leqslant 2\gamma$ and $\alpha - \gamma \leqslant y \leqslant \gamma$ where γ is the critical angle for the prism substance. In other words the conditions of the problem imply that

$$\arcsin \mu \sin (\alpha - \gamma) \leqslant x \leqslant \frac{\pi}{2} \text{ rad.} \tag{D}$$

From here on it is assumed that $\alpha < 2\gamma$ making the boundaries of the x region in D different. If $\alpha = 2\gamma$ the situation is trivial.

The following differential equations can be obtained by differentiating equations A, B and C with respect to x:

$$\left.\begin{aligned} \frac{d}{dx}\psi(x) &= 1 + \frac{dz}{dx}. \\ \frac{dy}{dx} + \frac{dv}{dx} &= 0. \\ \cos x &= \mu \cos y \frac{dy}{dx}. \\ \cos z \frac{dz}{dx} &= \mu \cos v \frac{dv}{dx}. \end{aligned}\right\} \tag{E}$$

Let x be in the region defined in D. Then it follows from C and the equations in E that $\frac{dv}{dx}$ will be a continuous single valued function. Therefore $\frac{d}{dx}\psi(x)$ must be a continuous single valued function, provided of course $\cos z \neq 0$. $\cos z = 0$ only if $x = \arcsin \mu \sin(\alpha - \gamma)$, as can be seen from A and C. Consequently $\psi(x)$ will be a continuous smooth flowing single valued function if $\arcsin \mu \sin(\alpha - \gamma) < x \leqslant \frac{\pi}{2}$ rad.

Now when x is in the region defined in D there must be a least value of $\psi(x)$ which is the value of $\psi(x_0)$, x_0 being a value of x in this region. Suppose $x_0 = \frac{\pi}{2}$ rad were true it would follow from the equations in E that $\frac{dz}{dx} = 0$. This in turn would mean that $\frac{d}{dx}\psi(x) = 1$, for it has already been found that $\arcsin \mu \sin(\alpha - \gamma)$ is the only value of x for which $\cos z = 0$, a value different from $\frac{\pi}{2}$ rad. Then according to the concept of continuous functions there must be a value of x immediately less than $\frac{\pi}{2}$ rad. for which $\psi(x) < \psi(x_0)$. Naturally this is impossible. Nor can $x_0 = \arcsin \mu \sin(\alpha - \gamma)$, for it is obvious from the figure that $\psi\{\arcsin \mu \sin(\alpha - \gamma)\} = \psi\left(\frac{\pi}{2}\right)$. So appealing to another fundamental theorem of continuous functions,

$$\frac{d}{dx}\psi(x_0) = 0. \tag{F}$$

The first equation in E can be multiplied through by $\cos y \cos z$ with the result that $\cos y \cos z \frac{d}{dx}\psi(x) = \cos y \cos z + \cos y \cos z \frac{dz}{dx}$. After doing this it is easy to deduce from the remaining equations in E that

$$\cos y \cos z \frac{d}{dx}\psi(x) = \cos y \cos z - \cos x \cos v. \tag{G}$$

Furthermore the equations in C can be multiplied together in such a way that

$$\sin x \sin v = \sin y \sin z. \tag{H}$$

Now let y_0, v_0 and z_0 be the values of y, v and z respectively when $x = x_0$. By virtue of G $\cos y_0 \cos z_0 \frac{d}{dx}\psi(x_0) = \cos y_0 \cos z_0 - \cos x_0 \cos v_0$, and then by virtue of F and H:

$$\begin{aligned} \sin x_0 \sin v_0 &= \sin y_0 \sin z_0, \\ \cos x_0 \cos v_0 &= \cos y_0 \cos z_0. \end{aligned} \tag{I}$$

The equations I can be added and subtracted, and these operations together with the addition subtraction laws of cosines lead at once to the result:

$$\cos(x_0 - v_0) = \cos(y_0 - z_0);$$
$$\cos(x_0 + v_0) = \cos(y_0 + z_0).$$

This means that either

$$x_0 - v_0 = y_0 - z_0, \tag{J}$$

or

$$x_0 - v_0 = z_0 - y_0, \tag{K}$$

and similarly that either

$$x_0 + v_0 = y_0 + z_0, \tag{L}$$

or

$$x_0 + v_0 = -y_0 - z_0. \tag{M}$$

Suppose that either J or M should be true, it would follow from B that $\psi(x_0) \leqslant 0$. But when x is in the region defined in D it always is possible for $y = v$, i.e. for $y = \frac{\alpha}{2}$. The reason is simple: $0 < \alpha < 2\gamma$, and therefore $\alpha - \gamma < \frac{\alpha}{2} < \gamma$. Now referring to B and C it is clear that $\psi\left(\frac{\alpha}{2}\right) > 0$. Thus since $\psi(x)$ is continuous and can never vanish while in the region defined in D, it must be true that $\psi(x_0) > 0$.

Evidently neither J nor M can be true, so K and L must each be true. It follows from addition and subtraction of K and L that $x_0 = z_0$ and $y_0 = v_0$. This proves that there is symmetry when $\psi(x)$ is a minimum regardless of how the μ constant is chosen. Of course the value of the minimum $\psi(x)$ depends upon the value of μ.

THE NATURAL HISTORY COLLECTIONS OF DENISON UNIVERSITY

C. JUDSON HERRICK[1]

Received October 28, 1946; published January 23, 1947

Systematically arranged collections of specimens in the broad fields of geology and biology serve two primary purposes: first, the exhibition of selected items carefully prepared and displayed for the instruction and pleasure of the public; and second, classified material laid away in storage for future study by qualified experts. Most large museums combine these functions and in many of them the study collections are larger and more valuable than the exhibits.

At Denison University the accumulation of study collections in natural history began with the appointment of my brother, (the late Clarence Luther Herrick, b. Minneapolis, Minn., June 22, 1858; d. Socorro, New Mexico, September 15, 1904) as professor of geology and natural history in 1885. In 1893, when Barney Science Hall was under construction, in view of the increase of this material and prospects of further growth, provision was made for more adequate care of it and for extensive exhibits. The east wing of the new building, accordingly, was designed as a museum with a high central court and galleries on all sides. Within a few years this building was overcrowded and the museum was encroached upon for classroom space. When the Barney building was reconstructed after the disastrous fire of 1905 the idea of a general museum was abandoned and since that time the college collections have been distributed among the several departments, with emphasis on material for study rather than exhibits.

During about four-fifths of the formative period from 1885 to 1907 I was on the ground at Denison as student and teacher, and it has been suggested that some of my recollections of those days may be of interest and of value in an appraisal of the present status of the collections now in use at this college.

My brother's activity as a collector, begun in early childhood just for the fun of it, was systematized when he entered the Minneapolis high school—at sixteen years of age— by the organization, in association with a half-dozen of his classmates, of the Young Naturalists' Society. The history of this remarkable band of high school pupils, which flourished from February 12, 1875, to November 18, 1878, has been recorded elsewhere,[2] with copious extracts from its records, which fortunately have been preserved and are now filed in the Museum of Natural History of the University of Minnesota.

Clarence's aptitude and industry as a collector and critical student of everything observed in the field were immediately recognized by Professor N. H.

[1] Aided by a grant from the Dr. Wallace C. and Clara A. Abbott Memorial Fund of The University of Chicago, Chicago, Illinois.

[2] C. Judson Herrick. Scientific pioneering in the Middle West. Sci. Monthly *54*, 49–56 (1942). The Young Naturalists' Society. Ibid., 251–258. Incubation stages of scientific investigation. Ibid., 361–369.

Winchell, director of the Geological and Natural History Survey of Minnesota; and very soon after his matriculation in the University as a subfreshman in September, 1875, he was appointed as Professor Winchell's assistant. During the nine years of his subsequent connection with the Survey the natural resources of the state were systematically explored and reports were filed. Mineral and agricultural resources of economic importance were not neglected, but the collector's personal interests in pure science were encouraged and given free scope. The dominant interest from the first was in the microcrustaceans of the local waters, and second to this was the collection of fossils from the strata underlying the university campus. The last year of this period was devoted to the preparation of a report on the mammals of Minnesota. Little of the crustacean material was preserved, but many of his other specimens are now in the University Museum at Minneapolis.

While at Denison during the years 1885 to 1888 he was very active in the field. His research at this time was chiefly in the domains of paleontology, stratigraphy and lithology, though every feature of the face of nature was scanned with interest. Students participated in most of these excursions and they were closely articulated with the teaching program. Thousands of specimens of invertebrate fossils were collected and many of these were described and illustrated in his own papers and those of his students, several of whom devoted their lives to this research. One of the most notable of these was the late August F. Foerste, who was connected with the Steele High School of Dayton, Ohio, from 1893 to 1932 and during this time served with distinction in the U. S. Geological Survey and the geological surveys of Ohio, Indiana, Kentucky and Canada, and from 1932 to his death in 1936 in the U. S. National Museum.

These activities have been continued and expanded by Clarence's colleagues and successors, and the scientific results achieved immediately became so voluminous that the problem of publication was acute. Within a few months after establishing his residence in Granville he issued the first number of the *Bulletin of the Scientific Laboratories* (December, 1885), a hazardous undertaking in view of the fact that it was a personal venture with no assurance of adequate financial support.

The event has justified the risk and the necessary funds have been found in diverse ways—appropriation of college funds as liberally as the small budget permitted, personal contributions by the founder and his colleagues and by other friends of the college, and also substantial subsidies by authors of the published papers. This remarkable record is explained and justified by the exceptionally high scientific quality of the material published from the beginning until now. One of the most interesting features of this research is the fact that so large a proportion of it was begun by undergraduate students of the college; indeed many of these studies were completed before graduation.

The name of the Bulletin was changed (in accordance with requirements of the postal authorities) in 1920 to *Journal of the Scientific Laboratories* and the current issue completes the 39th volume. By far the larger part of this material has been written by present or former members of this college. This, I venture to say, is a record of scientific achievement that is unsurpassed by any other privately

endowed college of comparable size and resources. The history of the first half century of the life of the *Journal* has been written by two of its leading contributors, Drs. August F. Foerste and Kirtley F. Mather,[3] with summaries of the more important articles.

The *Bulletin* was a favorite brain-child of its founder and this active interest and support lasted as long as he lived, but at its inception it lacked sponsorship that would ensure stability and continuity of policy. When the Denison Scientific Association was established on the 16th of April, 1887, this deficiency could be remedied and the *Bulletin* (now the *Journal*) became the official organ of the Association. The present permanent secretary of the Association, Dr. W. C. Ebaugh, has been editor of the *Journal* from 1925 to 1947 and his annual reports include lists of publications and records of stated meetings. A significant feature of these meetings from the beginning is the number of reports of research in process by undergraduate students. Not all of these people were specializing in science. It is interesting to note that nearly half of the charter members of the Association in 1887 were undergraduates in the classical course and that two of the faculty members were teachers of Latin (Chandler) and Greek (Johnson) respectively. In the following years the humanities have been represented by forty or more other faculty members and the scientific spirit infiltrates every department of the college. My brother's science was permeated by his humanism and this drew into the circle of his influence people of the most diverse endowment and training.

As soon as the Scientific Association was established Clarence proposed to begin the publication of a series of memoirs of quarto size adapted for publication of plates of larger size than could be accommodated in the *Bulletin*. In this, with characteristic temerity, he was following precedents set by the larger academies of science the world over. But when the Association became the sponsor of the *Bulletin* this unnecessary complication of the program of publication was wisely abandoned and only one number of the memoirs was issued.[4]

In addition to the two papers dealing with the history of the *Bulletin* and the *Journal* of the laboratories which have already been cited, there are other references to these publications and the work of the Scientific Association, some of which are listed in the accompanying note.[5]

[3] Aug. F. Foerste. The earlier history of the Bulletin of the Scientific Laboratories of Denison University. Jour. Sci. Lab. *29*, 205–227 (1934).

Kirtley F. Mather. Later history of the Journal of the Scientific Laboratories of Denison University. Jour. Sci. Lab. *31*, 170–195 (1936).

[4] C. L. Herrick. Contribution to the fauna of the Gulf of Mexico and the South. List of the fresh-water and marine Crustacea of Alabama, with description of the new species and synoptical keys for identification. Memoirs of the Denison Sci. Assoc. *1*, No. 1, 1–56 (1887).

[5] Alfred D. Cole. Founding of the Denison Scientific Association. Jour. Sci. Lab. *22*, 181–186 (1927).

Carey Croneis. Science and the college. Jour. Sci. Lab. *32*, 133–144 (1937).

C. Judson Herrick. An educational ideal for the small college. Denison Alumni Bulletin *2*, No. 3, pp. 2 and 18 (1911). Geology at Denison. Denison Alumni Bulletin *8*, 21 (1917). Science and living. Jour. Sci. Lab. *22*, 171–180 (1927). Our endowment. Jour. Sci. Lab. *32*, 145–153 (1937). Little academies I have known. Sci. Monthly *53*, 133–141 (1941).

The preceding bits of history are included here because they provide the background necessary for an appraisal of our study collections. It is true that these preserved specimens are tangible representatives of only a small part of the scientific investigation that has been fostered in this college for more than sixty years, but they are a significant part of it and their worth can be measured only in terms of the use which has actually been made of them for the advancement of knowledge. The published evidence that they have been profitably used is impressive. In addition to this, and perhaps more significant in the long view, there is the daily employment of this material in routine class teaching—more significant because this unheralded profit is cumulative, passing on from generation to generation of students in unbroken succession.

The first two decades of this history I myself witnessed and now it may be worth while to record some details about the method of work and the personal characteristics of the originator of our collections. The accompanying data regarding their present status and utility have been supplied by the members of the faculty concerned.

When my brother joined this faculty, at the age of twenty-six years, his early training and previous experience had been largely in field and museum work. He was one of the last of the all-'round naturalists of the tradition of von Humboldt and Louis Agassiz; and from the first he was more than a mere collector, as evidenced by the fact that a large part of the work in preparation of his "Final Report on the Crustacea of Minnesota," published in 1884, was done while he was still an undergraduate. The academic year 1881–82 was spent in Leipzig studying chiefly with Leuckart and here he learned the then most recent technical methods and scientific standards of current laboratory work in biology. Here also he studied petrology with Zirkel.

At Denison the local terrain was so rich in material for study of stratigraphy, paleontology and glacial geology that most of his field work was in these domains. An early interest in mineralogy was quickened by the recent application of the polariscope to the study of rock-forming minerals and in the first volume of the *Bulletin* he published "A Compend of Laboratory Manipulation (Lithological)," followed by 39 pages of "Tables for the Determination of the Principal Rock-forming Minerals. Translated and Modified from Hussak's Tabellen zur Bestimmung der Mineralien." This interest was probably the chief motivation for his longer collecting expeditions, notably those in the summers of 1886 and 1887.

The first of these was planned as one of a series of summer laboratory sessions of the college. The party, including a few advanced students, spent several weeks at Michipicoten Bay on the northeastern shore of Lake Superior, paying special attention to the igneous rocks there exposed as probable sources of some of the glacial boulders so plentifully scattered over the Ohio landscape. In the following summer, accompanied by his two younger brothers, he made an extensive tour through the Alleghany Mountains from West Virginia to South Carolina, thence to Mobile Bay for Crustacea and northward for a second visit to

Lake Superior. Miscellaneous collections were made on all of these trips and many of the rock specimens were ground into microscopic sections on a lithological lathe for study under the polarizing microscope.

Until 1894, when the Barney Science Hall was occupied, the college collections were stored in makeshift cabinets wherever space could be found for them, with incomplete labels on scraps of paper. As fast as the material was worked up it was laid aside and too often neglected. There was no attempt to systematize the collection and during successive removals labels were lost or misplaced and much material was discarded. What remained was assembled and classified in the Barney building. There were constant accessions, so that we soon had a good herbarium of local flora, a small collection of mammals and birds, and an excellent series of fishes presented to the college by the U. S. Fish Commission.

The fire of March 30, 1905, which destroyed Barney Hall and most of its contents introduced fresh confusion. Most of the zoological and botanical material was lost, but the greater part of the geological collection was salvaged by heroic efforts of the staff and students. The most tragic consequence of early neglect and the ravages of fire was the disappearance or loss of identity of priceless type specimens of the new species of fossils described in the early volumes of the *Bulletin*. Professor Frank J. Wright informs me that he has exhausted every possibility in an effort to locate these types, but without success.

The working collections of the Department of Geology are rich in local fossils and many of these bear the original labels written by "C. L. Herrick." The collection of minerals is large and representative. Professor Wright tells me also that two of the most prized and instructive specimens owned by the department are small blocks of Solenhofen lithographic limestone with polished faces engraved by my brother's hand. One of these is a plate of figures of crustaceans which was published in the *Bulletinn*. The late Frank Carney, who was professor of geology from 1904 to 1917, assembled a unique collection of lantern slides (many of them from his own photographs) illustrating all phases of geology and especially physiography. This, with subsequent increments, has inestimable teaching value. In 1906 Dr. G. K. Gilbert of the U. S. Geological Survey, in recognition of the distinguished record of our geologists, presented to this department his large private library of geological books and journals. All of these collections have played a significant part in maintaining the enviable reputation of this department of geology as one of the most efficient in this country in teaching, training of investigators, and research by the staff.

In 1902 it was suggested by an influential member of the Denison Board of Trustees that the department of geology be eliminated and the money thus saved be devoted to strengthening other scientific departments. The president and the trustees, with broader vision, did not approve this retrograde step, feeling that *nulla vestigia retrosum* is as good a motto for a college as for an individual. In 1917, at the request of the president of the Denison Alumni Association, I wrote a brief appraisal of the history of geology at Denison for the Alumni Bulletin.[5] The problem of the amount and kind of specialization which is appropriate in small colleges is admittedly difficult and the proper solution is doubtless different

in each institution. In 1911 I published some reflections upon this subject in the Denison Alumni Bulletin.[5]

After the fire of 1905 zoology and botany were temporarily housed in Talbot Hall and the lost working collections were slowly replaced. Since the dedication of the admirably appointed Life Science Building in 1941 these collections have been well arranged and cared for. Among the notable items here are a collection of insects of Ohio and many choice exotic species; also a collection of birds of Ohio, among which are some collected by Clarence Luther Herrick. In the herbarium the Ohio flora is represented by approximately 11,000 specimens of vascular plants contributed by many collectors, including the Herrick brothers, Gilbert Hicks, H. L. Jones, G. A. Davies, and M. E. Stickney. In the general collection there are about 5000 specimens contributed by those just mentioned, Wm. E. Castle, and many others. The most recent accession is the Wallace Cathcart collection of ferns, presented in 1942, which comprises over 8000 specimens from the world over. There are in addition some fungi and algae.

A review of the history of my brother's numberless collecting expeditions, large and small, seems to me to reveal in sharp relief the salient features of his character and of his contributions to science—his restless energy, resourcefulness, contageous enthusiasm, wide range of interests and competence, tireless industry, consuming passion for knowledge. And also, alas! some deficiencies that hampered all of his work and too often frustrated his ambitions. From the first amateurish endeavors of the Young Naturalists to his final exploration of the geology and natural history of New Mexico, his interests were spread over so wide a field that his reconnaissance surveys were fragmentary, and he had neither time nor patience to work up the data and material collected in well integrated and systematic order. He was a radical individualist and most of his enterprises were personal ventures without institutional or other outside support or collaboration in organization, operation or study of the material. It inevitably followed that the more extensive field trips were not well financed and equipped. The results achieved, if measured by the value of specimens preserved were quite inadequate return for the money, time and labor expended.

It is true that a large amount of material was collected about which many reports were published and this exploration was valuable pioneer work. But the recompense that weighs most heavily, if measured in the scales of actual worth for human welfare, is neither of these things. The casual way in which many of these trips were undertaken and their informality gave them an *esprit de corps* and an educational value of different quality from anything attainable in larger and more systematically organized field trips or great scientific expeditions sent out under official auspices with adequate staff and equipment.

A keen interest in everything around him is the hallmark of the naturalist, and with Clarence this was a possessive interest. So he began to collect things, but physical possession was not what he wanted except as means to an end. There was nothing in his makeup comparable with the miserly greed of the collector of rarities whose ambition is to have exclusive ownership of something unique just for the sake of having it. The specimens were collected for what they might

teach, and all too often after he had got the information from them that he wanted the objects themselves were neglected or discarded. It was not things but knowledge about things that he craved.

Clarence's character was firm, vigorous, self-reliant and resilient, but it was not homogeneous, equable and imperturbable. Sympathetic understanding and consideration for others was the secret of his magnetic attraction and inspirational wizardry. He had keen vision into human nature as he saw it in boys and men and generally he liked what he saw, but a tricky or venal nature he detested and for this sort of weakness there was no indemnity, no matter how brilliant the success in other ways.

These personal qualities explain his preeminence as a teacher and inspirer of men; but they also and inevitably imposed serious limitations upon the quality of his scientific research. All of his projects were prosecuted energetically to the limit of his endurance, but there were so many of them and they were so heterogeneous that there was no time to carry them through to satisfactory completion with adequate controls. He was preeminent as a reconnaissance surveyor; the details of the terrain and the final check and correlation must be supplied by others.

His success as a naturalist and as the progenitor of so many other men of creative vigor in diverse vocations was in large measure due to his experience in the field, continued in ever broadening circles as long as he lived. He knew his nature face to face as a going concern, not at second hand from musty books or pickled remains where the breath of life has been replaced by the effluvia of preservatives. Not that he was unmindful or unappreciative of the necessity for carefully controlled library, museum and laboratory study; but these researches, done of necessity in dusty archives and smoke begrimed cities, were animated and freshened by the free air of the open spaces which were his natural habitat and to which he returned at every possible opportunity.

My big brother had his limitations and imperfections, as do all of us, but these faults do not diminish the stature of the man. As Morley Roberts says in his illuminating portrait of W. H. Hudson,[6] "Truly, little things do not make a man less; the foothills cannot destroy the mountains, nor homes upon them diminish the glory of their peaks."

Clarence's temperament suggests comparison with that of S. S. McClure, the successful magazine publisher, who once remarked that he never picked up an idea sitting still;[7] but his active interest in things was more soundly based and more judiciously directed than that of the erratic New Yorker who said, "I always felt I judged a story with my solar plexus rather than with my brain." The two men had this in common: "To lose his enthusiasm is the worst thing that can happen to an editor—next to having been born without any."

The naturalist's handiwork, whether enshrined in museum preparations or in print, illustrates a pregnant sentence in Dr. Carey P. McCord's whimsical account of the experiences of an industrial physician,[8] where he says, "In every

[6] Morley Roberts. W. H. Hudson. A portrait. E. P. Dutton & Co., New York (1924).
[7] Ellery Sedgwick. The metropolis against me. Atlantic Monthly *178*, 94–99 (1946).
[8] Carey P. McCord. A blind hog's acorns. Cloud Inc., Chicago (1945).

made thing about you is a little piece of man." This remark is pointed by the story of a ladle man in an iron foundry who accidentally fell into an ingot mold just at the moment when molten metal was poured into it. That ingot was buried with appropriate services, for "there's a man in there." Seldom does a whole man go into a single item of his production, but something of him does go into everything that he makes, whether it be the sweat of his body or the travail of a prolific mind.

Though much of the physical property collected by these pioneers has been lost, the other values acquired are imperishable. They have been implanted where neither moth nor rust can corrupt, in the stream of life itself, for they reappear in the persons inspired by indomitable energy and courage directed with rare insight toward those things that make life more abundant and satisfying. My brother attracted boys and made men of them, and this collection of men influenced by his life is more valuable than anything that can be stored in museums.

DENISON SCIENTIFIC ASSOCIATION

Organized April 16, 1887

REPORT OF THE PERMANENT SECRETARY FOR JULY TO DECEMBER, 1946

(Excluding the Programs of President G. D. Morgan's Administration)

The college year 1944–1945 had meetings held in Life Science Building, on certain Tuesdays of the months September to April inclusive during the school session, but had no issue of the Journal of the Scientific Laboratories from January, 1944 to June 1945. This was due to World War II and its concomitants, viz.; loss of students and uncertainty as to their movements, and falling-off in professional or technical activity of both faculty members and students during this period of stress. With the resumption of regular publication have come two numbers each of our Journal during the years 1945 and 1946, in June and December respectively. It is hoped that the regular issue of the Journal may be resumed in April, August and December after these strenuous days have come and gone! The United States of America is not a military nation, bent on conquest; but when it is forced into a position where it must take up arms it allows nothing to stand in its way of attaining the ends of justice, to itself or to its allies, either men or materiel.

On account of the removal from Granville and Denison University of President R. M. Meyers, F. G. Detweiler was made President on September 25, 1945. At the same time G. D. Morgan was selected as Vice-President of the organization. President Detweiler was primarily responsible for the programs and the place of meeting (in Life Science Building) during the current college year.

Two numbers of the Journal of the Scientific Laboratories of Denison University appeared as follows:

Vol. 39, Articles 3–7, pp. 90–170, June, 1946.

Dyadic Operator Approach to a Study in Conics, with Some Extension to Higher Dimensions. James Loyd Shawn. 15 pp.

Dyadic Operator as Applied to Lines, Planes and Quadric Surfaces. Laura Lee Cowen. 7 pp.

Spectrograph and its Use in Spectrochemical Analysis. Betty Jane Oestmann. 21 pp., 5 figs.

Synthetic Rubbers. William Farrand Loranger and Robert Garfield Anderson. 22 pp., 2 figs.

Role of Suggestibility in Susceptability to the Size-Weight Illusion and the Phenomenon of Autokinetic Streaming. Suzanne Littell. 17 pp., 2 figs.

Vol. 39, Articles 8–9, pp. 171–174, December, 1946.
Existence and Condition of Minimum Deviation of a Prism. Robert E. Seall. 4 pp., 1 fig.
Natural History Collections of Denison University. C. Judson Herrick. 8 pp.
Report of the Permanent Secretary of the Denison Scientific Association. 183 pp.
Subject and Author Index. 195 pp.

A report of meetings held during 1945–1946 gave the following:

September 25, 1945

THE APPORTIONMENT OF REPRESENTATIVES IN CONGRESS. CHOSABURO KATO (Retiring President)

Due to the absence of any clear-cut provision for fractional representation in Congress some deviation from strict proportional representation is unavoidable. Various methods were used in the past, but all were found to be unsatisfactory. In 1921 for the first time a satisfactory mathematical analysis became available. After a prolonged debate in Congress lasting from 1921 to 1941 it was shown that the so-called "Method of Equal Proportions" proposed by Professor Huntington came nearest to solving the problem. The speaker analyzed various methods and showed their defects, and later demonstrated that the "Method of Equal Proportions" (upon a mathematical basis) was the best method of distribution available.

October 9, 1945

EXPERIENCES OF AN INVENTOR. GAMES SLAYTER (Owens-Corning Fiberglas Corporation)

Practical phases of production of new substances to be used in industry have in view both the producer and the consumer, or the formation of new substances by expediting old methods or making new materials needed by the public in general. Stress was laid upon the desirability of furnishing to industry products that would (a) be cheaper to make and to buy than those already used, and (b) be at the same time more valuable than those employed by the consumer. This increased value would include such qualities as flexibility, lightness in weight, resistance to impact, tendency to show little or no injury and surface marking due to contact with other materials. The lecture illustrated by actual specimens what was done with glass when it was treated by these essentially new methods.

October 25, 1945

RECENT PROGRESS IN MODERN MEDICINE. RUSSEL H. WILLIAMS, M.D.

The Denison University physician described newer therapeutic agents appearing in recent years, giving attention to the methods and processes developed during recent World War II. Beginning with outstanding examples, such as remedies for pernicious anaemia, progress was noted through the developments of surgery and the evolution of drugs like penicillin and the numerous sulpha family.

November 13, 1945

OBJECTIVES IN THE SCIENCES, AND METHODS IN ATTAINING THEM.

A symposium in which F. J. Wright was leader, and in which A. W. Lindsey, W. A. Everhart, L. E. Smith and L. G. Steckle took part. There are objectives for all scientific study and teaching, viz.: Accuracy and clarity, the analytical approach, imagination, patience in search of facts and testing them, a genuine desire to find the "how," distinction between cause and effect, a critical attitude of mind, the habit of using multiple hypotheses, etc.

Objectives in geology and geography: To see that the world is orderly although change is universal. To give one a background of knowledge and appreciation of the physical earth and its importance as a basis for man's economic and social development. Other objectives include an understanding of the scenery one views and of the practical value of large engineering projects.

Objectives in biology: Accuracy in observing animal and plant forms and ability to interpret significant points they reveal. Besides this there is necessary the evaluation of observed facts belonging to an ever-increasing knowledge of past life on the earth. There must be an ability to see for oneself, to use others' knowledge wisely, and to think on the basis of tested facts.

Objectives in chemistry: A high value placed upon the particle nature of matter and the great law of its conservation; the ability to deduce or explain basic laws such as the laws of gases, of solutions, of electrochemical action, of energy-transformations; ability to show the practical application of chemical principles in such matters, for instance, as foods, clothing, buildings, objects of art, medicines, fuels; realization of the close relationship throughout daily life between chemistry and the other sciences; and habits of accuracy in observation and expression.

Objectives in psychology: Aim toward such a study of human and other animal behavior as will make it an experimental science with adequate control, and with objective attitudes in appraising this behavior; demonstrate that such behavior is coherent, understandable, and predictable; relate together the facts of physiology, neurology, biology, and psychology, since psychology is the name for the department of thought that studies the integration of behavior on its "higher" levels; man can hope to improve the behavior of individuals in large groups only through a genuine understanding of the aims as stated, while the individual meanwhile understands himself.

Objectives in physics: The student must acquire the scientific attitude, to wit, an inquiring mind, an honest manner and painstaking care in the tiresome routine demanded by the details of experimentation; encouragement of active imagination to help when the procedure or method is not very clear; the coordinating knowledge and skills from all fields of endeavor to apply to the problem in hand; retention of some facts, some definitions, some actual skill of hand, a degree of background in his own experience, and the ability to think in an ordered manner.

November 27, 1945

THE TEACHING OF MATHEMATICS AT DENISON UNIVERSITY. FORBES B. WILEY, CHOSABURO KATO, and EDSON C. RUPP

Mathematics has many facts; it appeals to its various devotees in different ways. For some it is a fine art, for some an exact science, for some a concise and vivid language, for some an invigorating exercise in logic, for some a powerful tool, while others find in it an opportunity to express themselves creatively. Thus the courses must be thorough and also give glimpses of wide possibilities. The entering student, sectioned according to ability, must be handled with untiring patience for the correction of acquired faults and for training in reading, thinking, and expression. Some ways of accomplishing these aims were discussed in detail.

December 11, 1945

RECENT APPLICATIONS OF NUCLEAR PHYSICS. L. E. SMITH

A popular presentation was made of the nucleus, and the several elementary particles of modern physics. Their electric charges, their sizes and their properties were discussed. Using these concepts the idea of atomic and nuclear energy levels was presented. An elementary example of nuclear reaction was given, and the possibilities of such reactions were shown to lie in recent developments connected with cyclotrons, electrostatic generators and other modern devices. From such ideas the suggestion came that it might be possible to produce elements not found in nature. This has been accomplished. It is possible to predict rather well the properties of these new elements.

The phenomenon of nuclear fission was described in non-mathematical terms with an attempt to visualize the tremendous amounts of energy released by the reaction. Methods of isolating fissionable material were described, so as to make possible the atomic bomb. Other applications for more peaceful purposes are unlimited and at the present leaves plenty of room for speculation.

January 22, 1946

THE MIRACLE OF BLOOD. G. D. MORGAN

By blood scientists now can extract many weapons against disease and death. These are fibrinogen, thrombin, gamma and alpha globulins, serum albumin, red blood cells, and isohemoagglutinins. The isohemoagglutinogen known as the Rh factor causes incompatibility of mixed bloods. Eighty-seven per cent of the population of the United States have this factor. The remaining thirteen per cent are Rh negative. When an Rh negative person is given a transfusion of Rh positive blood, the first transfusion may cause only a slight reaction. However, if a second transfusion is given, the Rh positive blood causes the production of antibodies which destroy the Rh positive blood cells. The dead cells act as a poison in the kidneys of the recipient, and in severe cases may cause death. The Rh factor may also cause stillbirth, abortion, and erythroblastosis

fetalis. The latter condition is characterized by anemia and yellow jaundice in the new born child. These conditions can occur only when the mother is Rh negative, and the father is Rh positive. If the fetus is Rh positive, the Rh factor, in some manner, passes to the blood of the Rh negative mother causing the production of the anti-Rh agglutin which passes back through the placenta to the blood cells of the fetus, and causes the conditions mentioned. Statistical evidence also point to the Rh factor as the cause of a certain type of feeblemindedness among children. The Rh factor is inherited as a Mendelian dominant.

February 26, 1946

PSYCHOLOGICAL RESEARCH IN ANTI-AIRCRAFT GUNNERS. WILLIAM C. BIEL

A description of recent psychological experimentation in anti-aircraft gunnery carried on in close cooperation with the United States Army by one of the projects under the Applied Psychology Panel of the National Defense Research Committee. The work classified was under four general headings: 1. Selection of Personnel. This involved the development of and validation of tests for several Army jobs where selection of personnel was difficult. 2. Development and testing of training aids, devices and methods. This work ranged from the preparation of manuals to the development of and testing of devices and methods which men could use in training themselves and others to develop certain essential skills. 3. Development and testing of new equipment. Experiments and observations were conducted to test the ease of learning to operate new equipment and the accuracy with which it could be used. Recommendations were made for improving the new equipment to make it more suitable for use when human abilities and limitations were taken into account. 4. Comparison of methods of using military equipment. This consisted of testing or comparing by experiment, methods of using several types of anti-aircraft equipment. Experiments were described briefly which illustrated each of these general types of work.

March 13, 1946

DIVORCE IN OUR COURTS. FREDERIC M. BLACK (Common Pleas Court, Licking County, Ohio)

Problems of the family as they appeared in our present-day courts and particularly in judicial experience. The divorce rate was already rising before World War II, but since the date of Pearl Harbor it has been mounting most alarmingly. In post-war periods some counties were reporting divorce rates approximately equal to the rates of marriage. The speaker mentioned the fact that a court in a large city is often tempted to give judgment on divorce cases hastily, and illustrated by a judge who asked the attorney to confine his statement to a very few minutes. Judge Black himself insists on plenty of time and

sets the example of continuing cases for a period of six months, during which many of his cases are voluntarily withdrawn by the petitioners. As a result the percentages of divorces granted is considerably lowered.

April 9, 1946

BEAUTIES OF THE PLANT WORLD. Richard V. Morrissey

A popular lecture with the use of colored pictures of plants in certain areas of the United States as a guiding motive.

April 23, 1946

THE SPECTROGRAPH IN THEORY AND USE. Betty Jane Oestmann

W. A. Everhart, of the Chemistry Department made the first public announcement of the acquisition of a new spectrograph for use by the several science departments of the University. This is of the small Littrow quartz type, manufactured by the Bausch and Lomb Company. The spectrograph, complete with accessory equipment, is a valuable gift to Denison University in memory of an alumnus, Gershom Spencer Jones, Class of 1895, by his sister, Miss Keturah Jones, and in cooperation with another sister, Mrs. Edward B. Mathews. Under the direction of W. A. Everhart and L. E. Smith, of the Physics Department, the new equipment is used for the first time by Betty Jane Oestmann, a senior student working on an honors project in chemistry. An explanation of the principles used in such instruments, demonstaration of the new equipment, pointing out the various parts and explaining how they are utilized, and description of the nature of the analytical work carried out by means of the spectrograph, including an interpretation of some of the results.

A discussion period followed the address, and an opportunity was given to all present to examine and inspect the apparatus under consideration.

April 30, 1946

MANUFACTURE OF WAR-USE FABRICS. Robert K. Fox (Ohio Lens Company, Lancaster, Ohio)

In connection with the annual dinner of Denison Scientific Association the guest of honor interested the members with a description of specialized treatment of fabrics required for war-time uses by our armed forces. The work consisted of treating fabrics to render them essentially fire-, water-, weather-, and mildew-resistant. Examples of material treated were duck, paper, rope, thread, webbings and nets. Uses of some of the finished products were for tentage, tarpaulins, camouflage, harness, life rafts and life preservers.

April 30, 1946

At the banquet meeting of the members of the *Denison Scientific Association*, held at the Granville Inn following the regular dinner hour, officers were elected to serve during 1946–1947:

C. D. Morgan, *President*
F. J. Wright, *Vice-President*
E. C. Rupp, *Secretary-Treasurer*
L. E. Smith, *Librarian*
W. C. Ebaugh, *Permanent Secretary and Editor*
W. A. Everhart, *Assistant Permanent Secretary*

During the year 1946 a number of volumes of our *Journal of the Scientific Laboratories of Denison University*, varying from one to complete sets (or as full as our stocks permittted), were sent to members of our mailing lists—both foreign and domestic—who had applied for back numbers to make good deficiencies. Many of the collections of books of our foreign correspondents had been completely destroyed by enemy action, and many more were not heard from at all. Notification was received in the autumn that the International Exchange Service of the Smithsonian Institution was functioning again with a large list of foreign countries: the *Journal of the Scientific Laboratories* will be sent through this fine service to all that are upon our mailing lists to foreign countries. Domestic numbers will be sent out from our own offices as usual.

From the larger universities with their thousands of students flocking to their old as well as newly improvised campuses to the more modest colleges with less than a thousand students the report is the same: crowded conditions of work, living, and collegiate activity. Perhaps this is typified in some of the reports sent out from the office of President Kenneth Irving Brown at Denison University (at DENISON, Granville, Ohio. Various issues during 1946).

COLLEGE IS DIFFERENT

The freshman coming to campus directly from high school will find it so. The veteran returning to campus after years of battle experience will find it so. College is different from the pattern of prewar days.

For one thing, the campus of 1946 is a crowded campus. Three have been assigned to dormitory rooms which previously held two. Dormitories will be bursting at the seams. Town houses will overflow and many a family which never thought of taking "paying guests" will yield their spare room so that two more veterans can have their chance at a G.I. education.

The extra enrollment will bring other changes to the campus. Classes will be larger and some of the individual attention will of necessity be sacrificed. Colleges which have endeavored to keep the discussion-class at twenty-five may now be forced to increase the size to thirty-five; and in the large universities lecture classes will jump from two to five hundred.

Even the schedule of classes may be changed to seven o'clock in the morning and classes through the evening hours and still more classes in those drowsy afternoon hours which both faculty man and student abhor.

The campus will look different—different not alone in the extra number of men but in the presence of trailer camps which many colleges have planted on the edge of the campus and pre-fabricated houses and government housing units side by side with permanent buildings. The campus, too, is different in the number of married students. In antebellum days the married student was the rare exception; today he is a common garden variety.

But college is different in other ways as well.

With the sudden upswing in the age of the average student there has come a new maturity. The campus community is more adultish. Not that it has gone serious over night nor forgotten how to play, but the man who has endured Okinawa or Anzio is likely to think of Frosh caps or "hell week" as kid stuff.

Some have foolishly prophesied that the invasion of the veterans would bring a general lowering of academic standards. Nothing could be further from the truth. College after college has publicized their grade studies showing that the average grade of the veteran is higher than that of the civilian student. Our men and women with war experience want the best the campus of their choice has to offer, and that best applies to quality of instruction.

Many colleges during the interim of war and smaller student-bodies have been reappraising their objectives and the ways by which these objectives can be achieved. They have plans and blueprints for the years ahead; and they intend putting these ideas into action just as soon as money and personnel are available. These plans which have been made to strengthen the college will of necessity bring their changes—changes in curriculum and graduation requirements, new emphases and revised patterns.

Family Life education, which yesterday was largely preparation for tomorrow, has become a necessity for today. Romance has always flourished on a college campus but today with scores of married students enrolled and others contemplating marriage "during the next vacation," things are different and the course in family relations becomes a hope for the building of an enduring home. Veterans' wives are requesting counselling on home problems; and both men and women who know that their job is or will shortly be to handle the responsibilities of home-making and parenthood are asking for the kind of preparation that will make them adequate.

Too, there's a fuller and better job of vocational guidance to be done. For the eighteen-year-old the future appears certain—unless Congress again changes its collective mind. But for the discharged veteran the problem of a life-work is immediate and demanding. What are his abilities? That calls for testing. What preparations are necessary for the career of his choosing? That calls for counselling. Where is his chance of a job? That calls for placement.

Moreover, college is different in ways that are less tangible. There is a deepening of concern for international problems and the questions on which the fate of the world hangs in balance. Not all the veterans are interested, but some are. Not all the civilian students care, but many do. And these, together with the backing and encouragement of the faculty, are finding means to make the campus aware of 1946, its opportunities and its responsibilities. Forums and broadcasts, panels and quiz shows, campus news-sheets and dormitory headlines, lecturers and dormitory bull-fests: there is more of this sort of thing flourishing on our campuses today.

Yes, college is different—different even while it remains the essential opportunity to gain acquaintance with the best that men have said and done and dreamed—and are in the process of saying and doing and dreaming. Because it is different, it requires a larger measure of patience and understanding on the part of both the faculty member and the student. It will take a more vigorous and more continuous endeavor to make of the campus group a campus family sharing in a common purpose, searching for common goals.

Because there has come a revolutionary sense of starting again—as if one were living in the year One—we must hold fast to the best of our campus traditions which have meaning and the customs that give flavor to college. And at the same time we must use the new beginning to rid ourselves of the less desirable of the traditions and customs of other days. A campus which is different is an invitation to change.

And so, too, is the year 1946—an invitation to every student, man or woman, battle-worn veteran or untried high school graduate, an invitation to become in still larger measure intellectually capable, morally responsible, socially competent, physically fit, vocationally directed, and spiritually mature.

K. I. B.

Three Concerns

There are three special concerns that I have on my heart as together we face another Denison year.

The first of the three is that all the members of our Denison campus community, students and faculty, shall be intelligent and constructive in their efforts to aid America in taking her rightful place of responsibility in the family of nations. We are well aware how little we individually can do; nevertheless, we can do something. We are a part of that great body of public opinion which directs decisions and forges policies. To be an intelligent part of that public opinion we must be informed of national and international affairs; we must keep abreast of the issues in conflict; we must understand the ultimate objectives which our own country is pursuing, and the objectives, as far as they are revealed, that other countries are seeking. We must urgently, ardently seek for ways of reconciliation where conflicts arise.

Our student body will be poor, indeed, even with a winning football team, and a stirring choral organization, and successful fraternity life, *IF* we fail to be intelligent and constructive citizens of a democracy in the age when democracy must achieve itself or die. It would be rather dreadful to live in 1946 and not know the great issues of all history which are crying for solution.

It is important that we have good magazines and papers in the dormitories and that we read them. It is important that our evening lecture course, Peace and Reconstruction, which is to be taught by ten instructors and will deal with the major problems of our days, shall attract a large number of us, either as participants or auditors. It is with pride that we read an essay in the *Woman's Press*, by one of our Denison seniors, which won first prize in a national essay contest among college students on the theme of individual responsibility for the United Nations.

The second concern on my heart is that Denison shall take the largest place it is capable of taking in American education. In critical days like these, when never before have such numbers of students come asking for the experience of campus life, it is not enough to be just another college—one more in the already large list of Ohio colleges. It is not enough to do a conventional job reasonably well.

Obviously, it is not Denison's task to imitate our great neighbor, Ohio State, or to try to be all things to all students. Our work is defined as undergraduate studies of liberal arts and sciences. By tradition and purpose ours is a Christian campus, with very definite ambition to make the campus the kind that impels men and women to be their finest Christian selves.

Besides doing a thoroughly competent educational job, where conceivably might Denison make contribution to American education? I think of three possible areas:

1. Denison has for many years insisted in public and in private that her aspiration is the development of the whole man. The ambition is as old as life itself and many campuses are equipped with the facilities and the personnel for the training of the many sides of a man's complex nature. But the cry is being raised in some quarters that the college's exclusive job is to develop minds. Perhaps with our system of trained counsellors and our series of counseling clinics, there is contribution we can make toward *training the whole man*.

2. For four years Denison has been sponsoring an experimental program of Christian Emphasis, notably a Sunday morning group for students prior to the church hour and a series of community service activities. The trial of four years has convinced us that these two efforts must continue with renewed strength and that allied activities must be encouraged. Conceivably here is a contribution which Denison at her best can make to American education.

3. Denison is a strong fraternity campus. In a day when much is written and said against fraternities and when these social groups are on the defensive, it is possible that Denison may by example demonstrate how fraternities and sororities, fortified by special groups for non-Greek-letter men and women such as our American Commons Club for men and the Shepardson Club for women, can have a significant and a constructive part in the educational program.

The third concern is, Will our Denison students reach out to be a part of the student fellowship of other countries?

It is easy to be smug in Granville. The happy isolation of the Denison hill tempts one to easy satisfaction. But the world lies outside. How far can you reach beyond Granville?

It is a source of pride to all Denisonians that the student president of our Committee on Correspondence has been in Europe this summer, a delegate to two great world student conferences. We are proud, moreover, that our students were among those who manned the "heifer ships" for the United Brethren church in their efforts to feed a starving Europe.

To our own student body this year have come students from other lands, some of them brought here through the generosity of our own group in raising money for Foreign Sttdent Scholarships. They will speak to us eloquently of the needs of the young people of their lands and will bring to us and our campus something of this world-wide fellowship of students. We welcome with special joy our students from Norway, Greece, France, China, Mexico, and the Argentine.

1946 can be a problem-year with problems of swollen student bodies and inadequate student housing and veteran adjustment.

Or 1946 can be an opportunity-year with the opportunities of our increased student body and our closer campus living and the wider experiences of the veterans—an invitational year to intelligent world-citizenship, to constructive educational progress and to world student fellowship.

So much depends on point-of-view!

The Battle of the Campus

The eternal battle of the campus is not the battle of books, of which Swift wrote. Neither is it the battle between the students and the administration as one might easily suspect from superficial survey of certain campuses.

The battle of the campus is the battle of student groups, representing the two extreme ends of the line, struggling for the support and allegiance of the large middle group. It is not a single battle with one line of attack; it is a war waged on several fronts.

Take the struggle on the intellectual front. *It is fun to learn.* Life has few joys more compelling or exhilarating than the joy of discovery. But soon after the first grade, intellectually immature teachers succeed in disabusing the student mind of that great affirmation, and although experience has proved the joy, nevertheless what teacher says must be true—and accordingly learning becomes to many a small mind a necessary drudgery.

The student front on any college campus contains all shades of opinion on this fundamental question. At one end—call it left or right as you will—there is persuasion on the basis of experience that the activities of the mind and the discoveries of truth are among the most joyous moments of men's living. And at the opposite end stand those who pretend to believe and doubtless have persuaded themselves by their own doubts that life was made for fun and frolic in which the printed page and strenuous mental endeavor have no part.

Connecting the two ends is the "great in-between" of those young men and women who waver in their faiths and are open to persuasion. Both end-groups are the campus leaven, but unfortunately the advocates of fun and frolic untainted by print are sometimes the yeastier leaven.

The intellectual, however, is only one sector of the battle of the campus. Another large campaign is being waged, and will for decades continue to be waged, on the religious front.

For some college students the religious experience and its compulsion to a dedicated life are unquestioned realities. For others this is unexplored land with all the terrors of the unknown and some of the suspicions which terror carries. Some college students have built (and by the effort of building have made solidly their own) a working and workable faith, whereby higher ends are not confused with trivialities and today's pleasure is easily distinguished from tomorrow's need. Other students with spiritual immaturity, lacking the training which the church is intended to give, proclaim themselves men without standards. These are the two ends of the line as they form for battle. And in between again lies the

uncertain middle, confused as to direction, without commitments that constrain, ready to be won. The battle of the campus on the religious front is a struggle between the lonely good and the carefree pagan for the support of the unaffiliated "middle" student, who has not yet known either deep Christian loyalties or pagan allegiance.

A campus pulls in many directions. The responsibility of the faculty and administration is to see that as many of these tugs as possible are upward—at least off the lazy horizontal level. To achieve that end there must be continual study of admission policies, continual concern for faculty competence, continual vigil to secure the strongest teacher-personalities in a year when the bottom of the teacher-barrel has been polished by scraping.

Moreover, it must be clear where the institution officially stands in this battle of the campus. Are they on the side of the lonely good or the carefree pagan; or are they too in that great in-between, ready to be pulled by public opinion in either direction.

Every campus needs a Fellowship of the Lonely Good—although never, never must it be so called. These are not popular words. But somehow there must come to those who are on the end of the line fighting for ideals and high campus faith the assurance that they do not stand alone. They need the encouragements which come from knowing that there are others, many, indeed, who in the sanctity of their own lives are holding sacred the same ambitions and truths as are theirs.

One purpose of this Fellowship of the Lonely Good would be to help that group see themselves joyously and normally as campus leaven—as joyously and as normally as the happy pagans see themselves as campus leaven and reach without inhibitions to draw others into the sphere of their influence and the pattern of their living. To hold one's ideals high, to laugh with spontaneity, and to go one's own way in faithfulness, influenced and influencing, yet not overwhelmed or overwhelming—toward this end the Fellowship would bring support.

The student may forego his drinking if the one making the suggestion has found ways to keep his own life buoyant and valiant. He may seek for a higher standard of pesonal and campus honor if the one making the suggestion has himself been able to put the aura of attractive living around those standards. He may try the experiment of church going if friends give evidence through their daily lives of the advantages and profits which church going is intended to offer. He may reach for the companionship of God, if his friends have persuaded him by the authority of their personal living that the Father's companionship if both available and joyous.

The collegiate Christians in fellowship have in their hands a power to change and raise the level of living and thinking on their campus that they only slightly suspect. Supported by their present numbers, steeled with the courage that numbers can offer, they can, if they will, modify many a campus tradition and change the spiritual climate of many a campus. It is not organization they need. It is a fellowship of understanding and purpose and stout heart—and also, a smiling comradeship. With the assurance that their college supports the charter of their struggle and that the faculty and administration can be depended upon, they can create, if they choose to fulfill their destiny as campus leaven, a campus atmosphere that tempts upward and makes integrity, both individual and group, a mite easier.—K.I.B.

Our Colleges and Universities in the United States of America have truly come to a crucial point. Will they follow out the new course indicated for them, or will they take the old way of least resistance? Upon a proper answer to this question depends their whole future course!

For twenty-one years the undersigned has acted as Permanent Secretary of the Denison Scientific Association and Editor of the *Journal of the Scientific Laboratories of Denison University*. With January third, Nineteen Hundred and Forty-

seven, he will have reached the retiring age of the University. May his successor have as good faculty members to work for as those that brought the monthly meetings and the *Journal* to their high levels in the past! From the time of founding of our *Journal* by Clarence Luther Herrick in 1885 until the present date (December, 1946) an uninterrupted series of meetings and of publications have kept the fire of scientific achievement burning—an accomplishment of which not many institutions as small as Denison University can boast.

Respectfully submitted,

W. C. EBAUGH, *Permanent Secretary and Editor*

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